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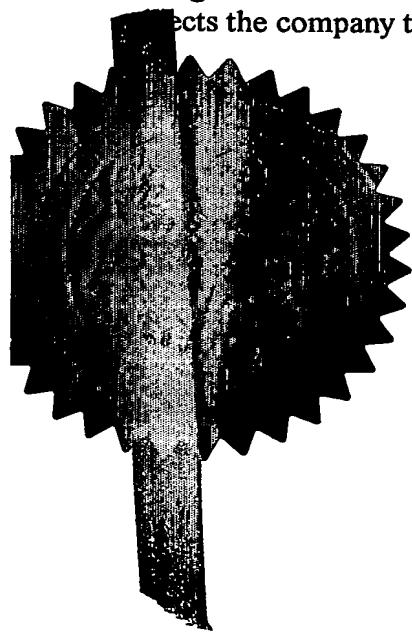
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The Patent Office
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Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1. Your reference

P035310GB

2. Patent application number

(The Patent Office will fill in this part)

0320880.8

- 5 SEP 2003

3. Full name, address and postcode of the or of each applicant (underline all surnames)

ENERGY AUTOMOTIVE SYSTEMS RESEARCH
(SOCIETE ANONYME)
Rue de Ransbeek 310
B-1120 Brussels
Belgium

8708364001

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

BELGIUM

4. Title of the invention

SMART ADDITIVE SYSTEM (SAS) DOSING PUMP

5. Name of your agent (if you have one)

CARPMAELS & RANSFORD

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

43-45 BLOOMSBURY SQUARE
LONDON
WC1A 2RA

Patents ADP number (if you know it)

83001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
(if you know it)Date of filing
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

Yes

- a) any applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an applicant, or
- c) any named applicant is a corporate body.

See note (d))

Patents Form 1/77

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Continuation sheets of this form

Description 2

Claim(s)

Abstract

Drawing(s)

2 12

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents
(please specify)

11. I/We request the grant of a patent on the basis of this application.

Signature

Carpmaels. Ransford

Date

05/09/2003

12. Name and daytime telephone number of person to contact in the United Kingdom

P.N. HOWARD

020 7242 8692

Carpmaels & Ransford

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Notes

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Smart Additive System (SAS) dosing pump

Technical field

The invention concerns a dosing pump for a liquid additive (possibly very concentrated) in the fuel tank of a heavy fuel (i.e. fuel having more than 9 carbon atoms; typically diesel) engine vehicle. The aim of such an additive is to lower the combustion temperature of the particles retained on the filter of the exhaust system. Typically, such additives are salts of iron (Fe) or cerium (Ce) in solution in a hydrocarbon solvent.

Prior art

Existing systems use a piston pump to dose additive liquid in diesel tank. The piston pump is a fixed volume pump, where the pump doses a constant pre-set volume per stroke. The dose is delivered by actuating the pump the required number of cycles. The disadvantages are that any error associated with piston volume is accumulated over the number of strokes and that solenoid valves are typically noisy. The new invention resolves these disadvantages.

Description of the invention (see figure 1)

The invention consists in replacing the fixed volume pump described above by a variable volume pump. Preferably, the variable volume pump is a syringe pump. The syringe pump is a variable volume pump that has a capacity equal to the maximum dose required, and dispenses a volume up to maximum dose.

Preferably, an electric motor actuation moves the syringe at very small increments, to achieve very high accuracy per single step. The syringe returns to an end stop, ensuring high repeatability.

Pump resolution, size and accuracy of a single step, is a function of the stepper motor resolution and is constant and independent of the volume delivered.

Syringe pumps deliver the entire pump volume within a short period of time.

Preferably, two simple passive valves are used and the system is flexible across a wide range of dose levels.

This concept is not noisy since it uses passive valves instead of solenoid valves.

Example (see figure 2)

The syringe pump's cylinder (1) allows to perform a dosing of very concentrated additive liquid (metal concentration rate 10%) for an add of diesel fuel (between 5 and 120 litres).

The syringe inhales through an in-hole in manifold (6), seal (5) and one-way valve (2) the additive liquid by the piston (3) performing only a single proportional course at calculated dosing quantity. The minimum linear step of the piston (3) is very small, in the range of 10 to 50 μm .

The piston (3) moves by means of a stepper motor and gear reduction (7). There is a sliding seal (4) between the piston (3) and the cylinder (1).

After the liquid inhalation, the syringe pushes through a out-hole in support (6), seal (5) and one-way valve (2) the additive liquid by the piston (3) to the diesel fuel tank.

The electric power consumption is very low (for instance 5 Watts at 12 Volts).

Characteristics/advantages

1. Syringe piston contacts end of Smart Additive System pump cylinder bore (bottoms out) at the end of each dose cycle. A benefit being the returning of the piston to known datum position.
2. Syringe piston contacts end of Smart Additive System pump cylinder bore (bottoms out) at the end of each dose cycle. A benefit being the head of the piston seals against the inlet and outlet apertures of the pump, thus sealing the apertures and preventing flow of the additive through the pump, when not in operation.

3. Syringe piston contacts end of Smart Additive System pump cylinder bore (bottoms out) at the end of each pump dose cycle. A benefit being that the stored volume of additive in the pump body is minimised, and minimises the potential out-gassing of gas or vapour from the additive that may occur during temperature changes.
4. The Smart Additive System pump can be located in the least 4 locations within the fuel system (a. under the additive reservoir in filler pipe area, b. between the additive reservoir and the diesel fuel tank c. above the diesel fuel tank, d. under the diesel fuel tank). The benefit being that a common pump body design can be incorporated into many different system configurations, through the use of bespoke fluid manifolds.
5. The Smart Additive System pump is self-priming. The benefit being that the pump can be primed through normal operation.
6. The Smart Additive System pump capacity is variable and doses the required amount of additive in one pump dose cycle. The benefits being that the error of dose size is limited to the error in the linear travel of the piston in one pump dose cycle.
7. The position and motion of the piston in Smart Additive System pump is controlled by a linear actuator driven by a rotary electric motor through a gear reduction. The benefit being that the gear reduction affords high precision in linear position that corresponds to a high accuracy in volumetric dosing of the additive and is not noisy.
8. The position and motion of the piston in the Smart Additive System pump is controlled by a linear actuator driven by a rotary electric motor through a gear reduction. The benefit being that the gear reduction affords high resistance to piston travel when the rotary electric motor is not energised, thus ensuring that the piston maintains a seal against the inlet and outlet apertures, as in point 2 above.

Figure 1

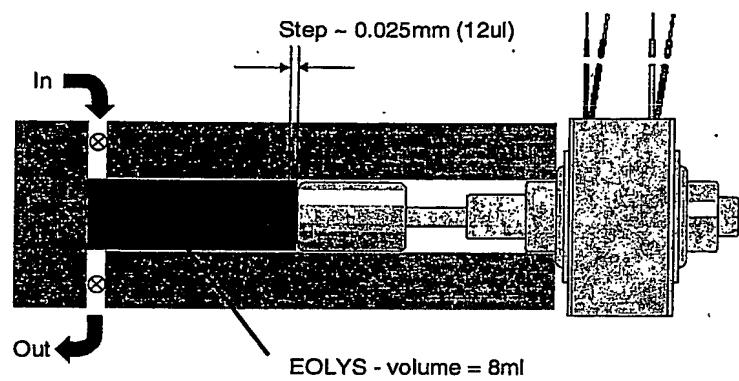
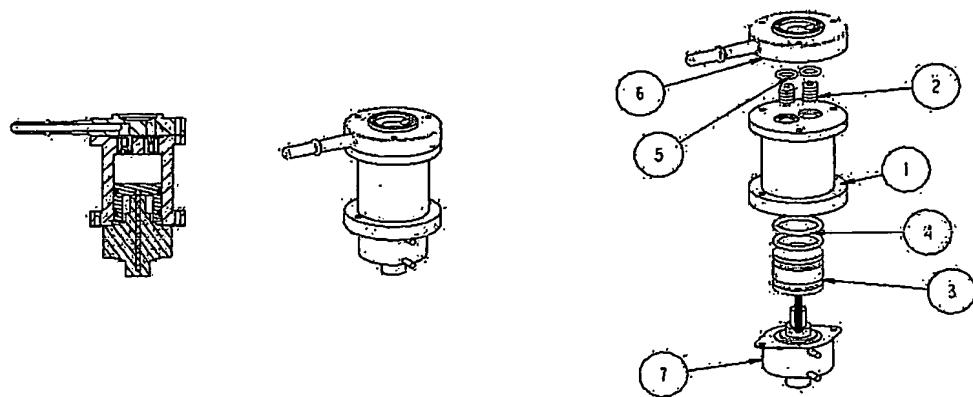


Figure 2



ITEM	NAME	TYPE	DESCRIPTION	SUPPLIER_REF	QTY
1	C7074-DP-003	PART	Prototype pump cylinder	default = GCL	1
2	C7074-DP-004	PART	Lee CCP1 Check valve	default = GCL	2
3	C7074-DP-005	PART	Prototype pump piston	default = GCL	1
4	C7074-DP-006	PART	Works-like piston seal	default = GCL	2
5	C7074-DP-009	PART	Works-like manifold seal	default = GCL	2
6	C7074-DP-010	PART	Neildon manifold	default = GCL	1
7	C7074-SA-001	ASSEMBLY	36000 Series stepper linear actuator	default = GCL	1